ESD-TR-68-371

AN EVOLUTIONARY PLAN FOR THE INTEGRATED USAF MEDICAL INFORMATION SYSTEM

Ronald A. Creamer, Hq Electronic Systems Division
George A. Fagan, The MITRE Corporation

September 1968

JOINT AEROSPACE MEDICAL DIVISION/ELECTRONIC SYSTEMS DIVISION STUDY

DIRECTORATE OF PLANNING AND TECHNOLOGY
COMMAND SYSTEMS DIVISION
ELECTRONIC SYSTEMS DIVISION
AIR FORCE SYSTEMS COMMAND
UNITED STATES AIR FORCE
L. G. Hanscom Field, Bedford, Massachusetts

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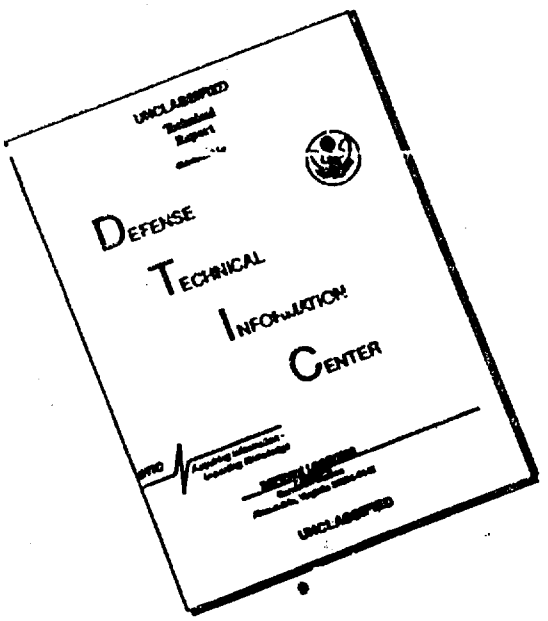

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FOREWORD

This report describes an approach for evolving the integrated USAF medical information which is described in AMD-TR-68-2, "Hospital Information System Feasibility Study," dated August 1968.

The information generated in support of this document was provided by the Joint AMD/ESD Medical Information Study Group, consisting of members from the Aerospace Medical Division (AMD), Wilford Hall Hospital (WHH), the MITRE Corporation and the Electronic Systems Division (ESD).

Lt. Colonel William S. Beck was the AMD project engineer. Mr. George A. Fagan was the project leader for the MITRE Corporation. System Engineering direction was provided by Mr. Ronald A. Creamer of ESD.

This report has been reviewed and is approved.

RONALD A. CREAMER
Project Officer

WILLIAM F. HEISLER, Colonel, USAF
Chief, Command Systems Division

WILLIAM S. BECK, Lt Colonel, USAF, MSC
AMD Task Scientist

ABSTRACT

This planning document describes a method by which the Integrated Medical Information System could evolve. The program is delineated into six categories:

Patient care facilities

Regional (inter-hospital) activities

Central (inter-regional) activities

Research and education aspects

Special projects

Automated Armed Forces Entrance and Examination Stations (AFEES) (induction centers)

The first four categories are recommended to evolve sequentially whereas the special projects can be handled independently, and later be included as their development matures. The last category, automated AFEES, was included to imply an inseparable relationship between the initial medical record and the subsequent records generated during active duty; however, the automated AFEES is covered in more depth in other documentation.

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"FORGING MILITARY SPACEPOWER"

PROGRAM SCHEDULE

SYSTEM (Project) NUMBER

SUBSYSTEM
B

TYPE OF SCHEDULE
DEVELOPMENT

AS OF DATE
25 September 1968

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AFSC FORM JUL 61 103

REPLACES ARDC FORM 103, JUN 60, WHICH IS OBSOLETE.

AFSC (AAFB) 1964

I. INTRODUCTION

The requirements for a Medical Information System Project have been stated in Aerospace Medical Division's Technical Report No. AMD-TR-68-2, "Hospital Information System Feasibility Study," dated August 1968. In addition to identifying general and specific requirements based on actual and anticipated deficiencies, this document also describes what the ultimate system configuration and its associated benefits could be, some project management considerations, some views on tri-service involvement, and some considerations on effectiveness rationale. It does not provide specific recommendations on the manner in which the program should evolve. The purpose of this document is to identify an approach to the automation of medical data which will satisfy the requirements identified in the AMD TR.

For the sake of project engineering management, the total effort has been divided into six major categories:

Patient Care Facilities (Hospitals, Dispensaries)

Regional Aspects (Inter-Hospital)

Central Aspects (Inter-Regional and Inter-Agency)

Research and Educational Aspects (Including AMD Laboratories and USAF School of Aerospace Medicine (SAM))

Special Projects

Automated Armed Forces Entrance and Examination Stations (AFEES)

These categories will be defined in succeeding paragraphs together with a recommended methodology for initiating or continuing activity within each. The last category, Automated AFEES, is recognized as an Air Force project with DOD-wide application, and as such will be considered in separate correspondence. Nevertheless, mention of it is made in this document because of the obvious probability of cross-fertilization between it and the Medical Information Project, and the possibility of the latter's becoming a tri-service effort.

II. PATIENT CARE FACILITIES

This category includes all hospitals and dispensaries, and involves those activities which occur within the facility itself. Because this is the category which appears to have the greatest amount of operational

difficulty, a considerable amount of mission analysis has been conducted on it. For this reason, the study group's understanding of the patient care facilities problem and the recommended activities to be accomplished therein are in extensively more detail than are the other five categories. Discussion with personnel directly involved in clinical medicine and hospital planning resulted in the conclusion that efforts should be expended within two frames of time reference.

(1) Development of useful products for application to specific functions within a hospital in a reasonable short span of time.

(2) Development over the longer term of an on-line transactional system aimed at improving intra-hospital data acquisition, storage and retrieval.

A. Near Term Activities - This portion would be conducted mostly at the Wilford Hall USAF Hospital (WHH) at Lackland AFB, and would concentrate on determining, specifying and implementing applications which would effect improved operations at WHH, and have potential wider application to other USAF hospitals.

In general, each application would serve a specific hospital department, but it is considered that the improvements to be achieved will benefit other departments indirectly. The candidate areas recommended for initial advanced development activity are:

Clinical Pathology Laboratory

Food Service

Pharmaceutical Inventory Control

Patient Census File

Radiotherapy Dosage Calculations

It is likely that most of these applications would be pursued on a batch processing computer basis, using any appropriate computers made available for the medical facility's use such as the soon-to-be available Phase II, Base Level Computers. However, particularly in the case of the clinical pathology laboratory, a dedicated on-line system is probable. Assuming that adequate resources and a stable development environment prevail, it is estimated that working end items could be developed within one year of the initiation date.

1. Guidelines - The short term effort would be subject to the following guidelines:

a. Implementation will be predicated upon the utilization, to the maximal feasible extent, of equipment which is already available or in the process of acquisition.

b. Although the design and implementation would be conducted almost exclusively at WHH, emphasis will be placed on non-unique solutions which will have a potential value and application in a variety of hospitals throughout the Medical Service.

c. Even though the end products are expected to be self-sufficient, they would be designed with due allowance for their integration into the eventual transactional system which will be unique and dedicated to the Medical Service.

d. Early operational capability will be stressed for each product, with appropriate recognition of associated field training and user adaptation aspects.

2. Prerequisites - Before entering into a design phase, the following technology surveys will be necessary:

a. Review of existing applications in other governmental and civilian institutions.

b. Familiarization with capabilities, source languages, and procedures for Phase II computer (Burroughs B3500) installations.

c. Advanced development activities in the pertinent department within WHH. These would also serve as an indoctrination and familiarization exercise for the augmented user/designer staff.

3. Product Goals - The near term goals of this activity would be:

a. Technical status summaries of the state-of-the-art relating to each particular function.

b. Detailed functional descriptions, computer programs, hardware specifications, and training plans for the selected functions.

c. Computer programs, and operating and procedural instructions for usage by USAF hospitals in general.

d. Recommendations for continuing efforts on other short-term applications which appear to have merit.

4. Action Agencies - For the near term effort, action would be divided among three USAF agencies as follows:

a. Development and operational evaluation of near-term applications up to and including the specification of software, hardware and training plans for selected functions would be the responsibility of Air Force Systems Command (AFSC).

b. Implementation of these evolved functions and the conduct of user training, as well as the updating of programs in the field as refinements mature from the development activity would be the responsibility of the Air Force Data System Design Center (DSDC).

c. Approval authority for the selection of a particular application, its adequacy, and its subsequent implementation in the field will be within Hq USAF. The Surgeon General's Office (SGO) would be the office of primary professional interest, and Hq USAF (AFRDDG) would be the office of primary project responsibility.

B. Transactional System - The concept of a transactional system to improve intra-hospital communication suggests several advantages which have been discussed previously, but will require an experimental and incremental or evolutionary development with the close cooperation of medico-professional personnel. Although current technology seems to be sufficient to support such a system, the experience of other workers in this field indicates that the specification of the most effective automated applications and procedures requires interactive assessment in the working environment of a hospital. In particular, the selection of terminal devices which will satisfy the users' needs in a timely and convenient fashion requires that the users themselves participate in evaluations under normal conditions of stress, load, and pre-occupation. In addition, it is expected that the users, by participating, will become aware of the potential value of these new tools, and will then be able to suggest potential applications of which the non-medical system engineer or data processing specialist may be unaware. It is therefore recommended that an experimental development facility be established for advanced development work on a transactional medical system. The objectives of the effort at the pilot facility are the development, analysis, and testing of an on-line data processing system as an aid to intra-hospital communication, hospital management, and higher echelon use of acquired data, as well as the production of detailed specification for such a system.

1. Guidelines - In view of the many experiences of the civilian medical data automation efforts which have encountered disappointing progress in most cases or outright failure in others, it would seem that a great deal of importance should be attached to the controllability of the development environment. The development of a transactional system will be more orderly and, correspondingly, more rapid and effective if it is begun in an experimental computer design laboratory, refined with the user in a smaller medical facility, and evaluated at a highly-specialized consultant center. Accordingly, the following are the guidelines for the transactional system:

a. Preliminary system design effort should be conducted within the Electronic Systems Division Complex at Hanscom Field, Bedford, Mass.

b. An experimental development activity should be established at the 40-bed hospital at Patrick AFB, Florida. (It will be here that the transactional system will be developed with user participation.)

c. Within a year of the establishment of the experimental development activity at Patrick, an experimental evaluation facility should be established at Wilford Hall Hospital. This facility would serve as a proving ground for replicating those applications developed at Patrick, would also be the location for evaluating the acceptability of particular functions for USAF-wide proliferation, and in this process would gradually evolve a greater capability until a viable hospital information system had become operational at WHH.

2. Prerequisites - As the initial stage in the advanced development phase, the following activities would be necessary prior to initiating activity in the experimental development facility.

a. A survey of existing applications, available computer programs, remote terminal state-of-the-art, and the capabilities of data processing hardware anticipated for the early 1970 decade.

b. A detailed analysis of operation at the Patrick and Wilford Hall hospitals which would address:

Information Generation and Flow

Procedures

Quantitative Traffic Analysis

c. Specification of the initial transactional system functional requirements.

d. Selection and installation of suitable hardware and support software components at the experimental development facility at Patrick, initially, and the experimental evaluation facility at WHH eventually.

3. Product Goals - The following products would be anticipated by the conclusion of the hospital automation development program:

a. Technical reports on the state-of-the-art.

b. Periodic reports defining progress.

c. A development team-approved configuration plan with alternatives and final specifications for the dedicated transactional system.

d. A decision document which delineates the advantages of the transactional system versus the cost, as compared to the manual mode of operation (i.e., an effectiveness evaluation).

e. A recommendation stating whether or not to proceed with world-wide acquisition of the system.

4. Action Agencies - Responsibilities concerning the transactional system for the Medical Service would be as follows:

a. AFSC would conduct the development, produce the reports, plans, evaluations and make the recommendations mentioned in paragraph 3, Product Goals, above.

b. Hq USAF would be the approval authority for adopting new techniques and procedures, phasing out the older, less pertinent ones, and would be responsible for interfacing and coordinating activities with other governmental agencies such as the Army, Navy and Public Health Service. Hq USAF would also determine whether the developed system is suitable for acquisition on a USAF-wide basis and would recommend, if appropriate, a tri-service effort with DOD-wide application.

III. REGIONAL (INTERHOSPITAL) ACTIVITIES

The regional aspects of the project have not been studied in the detail necessary for initiating a proposal for advanced development or concept formulation package. Consequently further studies and analyses of the operations at this level are essential to the development of a total system.

A. Objectives - The objectives of the Regional Effort would fall in two distinct phases:

1. Mission Analysis - There is a need to examine in detail, those activities that occur within a hospital region for the purpose of understanding how a region operates, what the deficiencies are and what remedies can be applied to the deficiencies. The objectives of this effort would be to determine which regional activities can be improved together with identifying procedural and hardware techniques which can possibly overcome the deficiencies. The product of the mission analysis would be an advanced development plan.

2. Advanced Development - The establishment of an experimental region for the sake of development considerations alone might be more costly than can be justified; consequently there should be an alternative to this.

a. Even if the establishment of an experimental development region were effective from a cost standpoint, its progress would be paced by the progress made in the experimental development activity for the transactional system at Patrick. As an alternative, then, to initiating development activity in an experimental region, it would seem worthwhile to establish a regional simulation effort, synthesizing an environment and proceeding with the development activity as far as possible with artificial means.

b. At the time when the transactional system has been approved for implementation, it would be desirable to arrange the installations on a regional basis. Once the medical facilities within the first region were equipped with transactional systems, it would be possible to complete the development of the regional system with user participation in a live regional environment.

c. When or if the regional system were considered to be adequate for USAF utilization, it would be implemented, a region at a time, when all the hospitals and dispensaries within the region had been equipped with the transactional system.

IV. CENTRAL (INTERREGIONAL) ACTIVITIES

As with the Regional effort, an extensive mission analysis will be necessary to understand the macrocosm of the Medical Service as it presently exists, defining not only interregional aspects but also the relationships that exist between the USAF Medical Service, AMD's research laboratories and the USAF School of Aerospace Medicine, the

Army, Navy, Public Health Service and others which interact with USAF in one way or another. The sequence of efforts and the types of activities of each are similar to those of the Regional. A great deal of simulation would be necessary at the start of development, and should the simulation show promise for proceeding with further development in user environment, the development would again be paced by the progress made in the system elements (hospitals, regions, laboratories, etc.).

V. RESEARCH AND EDUCATIONAL ASPECTS

An individual mission analysis for each AMD laboratory and the USAF School of Aerospace Medicine is necessary to determine how these facilities presently operate, what data is shared or communicated among them, what relationships exist between them and the Medical Service, and what problems and potential solutions to them exist. Development plans for each facility should be the product of the mission analysis, and the actual development phases should be conducted in the user environment with user participation. Simultaneous with these development efforts, there should be a higher order activity that addresses applications to interlaboratory and intramedical system relationships. As with the other macro efforts, considerable simulation would be involved prior to the hardware stage. It is conceivable that this higher order effort would be conducted as a portion of the Central activity.

VI. SPECIAL PROJECTS

The category of "Special Projects" involves those study and development activities that can be conducted either within or external to a hospital but need not necessarily be conducted as a part of the transactional system; they can be conducted in parallel with the main stream of work. (It should not be construed that special projects would be conducted in isolation from the other medical information efforts. On the contrary, a close liaison should exist among all aspects of the total effort; this implies a strong and centralized project management group.) As these special projects are developed, evaluated and acceptec by medical and legal authority, they can be integrated with the transactional system. This incremental absorption is advantageous to the special project development team because the team's initial design activity need not be interferred with by the transactional system development team. The transactional system development team need not be faced with integrating the special project applications with the transactional system all at once. And finally, the hospital itself would be hampered less and eventually benefit more by the incremental introduction of procedural and instrumentational changes to the clinical environment.

A. Candidate Projects - The total number of special projects has not been established, however, some have been considered, and are described

below. The number of projects that can be conducted in parallel is limited only by available resources. This "special projects" category, therefore, can behave as a shock absorber when significant budget fluctuations affect the overall program, confining the activity on simultaneous special projects to a few when resources are meager, or expanding the number should resources be plentiful. Early initiation of the first four special projects listed below is recommended because of the availability of unique facilities and experienced personnel.

Tumor Registry

Patient Monitoring

Radiograph Remoting and Analysis

Procedures and Regulations Study

Poison Control Center

Medical Corps Organization

Automated Patient Interviewing

Disaster Control Center

Automated Physicals

Computer Aided Diagnosis

VII. ARMED FORCES ENTRANCE AND EXAMINATION STATIONS (AFEES)

The automated AFEES pilot effort has been addressed in considerable detail in separate documentation which has been submitted in response to a DDR&E request. Nevertheless, the screening techniques developed under and applied to the induction centers will have potential application to annual physicals of USAF personnel.

VIII. SCHEDULING

The phasing of these activities is shown in the attached AFSC Program schedules. Factors such as actual initiation dates, amount of funds expended, the degree of problems encountered in the development phases, and variations in administrative decisions for different aspects of the program will all ultimately affect the schedule; therefore the specific years of initiation are deliberately left blank. The time intervals shown for each milestone are reasonable, in the author's judgment.

PROGRAM SCHEDULE | SYSTEM (Project) NUMBER | SUBSYSTEM: A | TYPE OF SCHEDULE: DEVELOPMENT | AS OF DATE: 25 SEPTEMBER 1969

LINE		PRIOR SCHEDULE DATES			COMPLETION DATES			LINE
		OPR	P	REV	FY	MO	D	
1	Required Operational Capab.(ROC)							1
2								2
3	Medical Facility Activities							3
4	Mission Analysis							4
5	Development Plan							5
6	Advanced Development							6
7	Near Term Applications							7
8	Experimental Fac Acquisition							8
9	Evaluation Facility Acquisition							9
10	Test and Evaluation							10
11								11
12								12
13	Region(Inter-hospital)Activities							13
14	Mission Analysis							14
15	Development Plan							15
16	Advanced Development							16
17	Simulation							17
18	Regional Development(Tech.,Sys)							18
19	Test and Evaluation							19
20								20
21								21
22	General(Inter-regional)Activities							22
23	Mission Analysis							23
24	Development Plan							24
25	Advanced Development							25
26	Simulation							26
27	Inter-regional Synthesis							27
28	Test and Evaluation							28
29								29
30	Research and Education Activities							30
31	Mission Analysis							31
32	Development Plans							32
33	Advanced Development							33
34	Simulation							34
35	Facility Acquisition							35
36	Test and Evaluation							36

FY 19 | CY 19 | J F M A M J J A S O N D J F M A M J J A S O N D | 1 2 3 4 1 2 3 4 1 2 3 4

AUTHENTICATION

AFSC FORM JUL 61 103 — REPLACES ARDC FORM 103, JUN 60, WHICH IS OBSOLETE. — AFSC (AAFB) 11164

Security Classification

DOCUMENT CONTROL DATA - R & D

Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY *(Corporate author)*
Joint Aerospace Medical Division/Electronic Systems Division,
L G Hanscom Field,
Bedford, Mass, 01730

2a. REPORT SECURITY CLASSIFICATION
UNCLASSIFIED

2b. GROUP
N/A

3. REPORT TITLE
AN EVOLUTIONARY PLAN FOR THE INTEGRATED
USAF MEDICAL INFORMATION SYSTEM

4. DESCRIPTIVE NOTES *(Type of report and inclusive dates)*
None

5. AUTHOR(S) *(First name, middle initial, last name)*
Ronald A. Creamer, Hq Electronic Systems Division
George A. Fagan, The MITRE Corporation

6. REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
September 1968	11	0

8a. CONTRACT OR GRANT NO.	9a. ORIGINATOR'S REPORT NUMBER(S)
IN-HOUSE b. PROJECT NO.	ESD-TR-68-371
c. d.	9b. OTHER REPORT NO(S) *(Any other numbers that may be assigned this report)*

10. DISTRIBUTION STATEMENT
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11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY
	Directorate of Planning and Technology, Command Systems Division, ESD, AFSC, USAF, L G Hanscom Field, Bedford, Mass. 01730

13. ABSTRACT

This planning document describes a method by which the Integrated Medical Information System could evolve. The program is delineated into six categories:

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Central (inter-regional) activities

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DD FORM 1 NOV 65 1473

Security Classification

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Hospital System						
Medical System						